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REQUIREMENTS FOR BOLTS AND SIMILAR FASTENINGS FOR PERMISSIBLE ELECTRICAL EQUIPMENT[1]

By L. C. Ilsley[2]

The observations made by Bureau of Mines engineers of permissible equipment installed in about 40 mines have indicated a chance for improvement in designs calling for the use of bolts, screws, studs, etc., especially with respect to bolt sizes and protection from mechanical injury.

Minimum Size of Bolts

In a recent conference with engineers of a large manufacturing company the question of bolt sizes was being discussed, and a story was told which fits the case so well that it is included here. It seems that a young engineer brought a design having $\frac{1}{2}$-inch bolts to an old-time engineer for criticism. The latter said the bolts should be larger; the other argued that they had an adequate factor of safety. The old engineer said "Young man, in mining work engineering sense begins with $\frac{1}{2}$-inch bolts." And this is the position Bureau of Mines engineers take after seeing the trouble experienced in maintaining equipment in mines where smaller than $\frac{1}{2}$-inch bolts are used. Having been convinced of this point, the bureau is urging everyone to take this matter under careful consideration when bringing out any new designs.

Protection of Bolt Heads

Field investigations have also shown that where bolt heads are exposed to the wear of chains, ropes, or even coal and rock ribs, the equipment is rendered less than safe and in effect becomes substandard. This point should be kept in mind when laying out new designs where permissibility is involved.

Spacing of Bolts

No fixed rule for spacing bolts can be laid down. Compartments having flanges in one plane will require closer bolting space than stepped flanges. The bureau's criterion of sufficient bolting rests solely on whether flames are restricted. It is not good practice to have a bolt so located with respect to a corner as to leave the corner to any considerable extent unclamped in case

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the corner bolt is missing. As far as feasible, to be effective bolts should be on or near the flange center line. A large number of bolts prevent ready access to the compartments. This fault can in some cases be largely overcome by providing more accessible inspection openings in the bolted cover.

Projecting Studs to be Avoided

Studs should not project through the nuts. In a typical case the thread which is above the nut becomes battered, and in trying to remove the nut the stud is loosened. Each time the stud is removed, dirt gets into the hole, and finally the stud enters the hole only a little way, stripping the few effective threads. This means that the hole must be re-drilled and tapped for a larger stud, also the hole in the cover must be enlarged and an oversize stud obtained. In many cases the operator does not go to this trouble and no fastening is used at that particular point. This is an important point in the maintenance of permissible outfits.

Length of Cap Screws and Studs

The bureau is checking the size of cap screws and studs used in bottomed holes to make sure that they are not too long. If they are too long they may bear on the bottomed hole before the head has a chance to do its work in tightening the compartment. Cap screws and studs should not bottom even if the lock washer is omitted. Flat-headed screws are particularly difficult to inspect for this fault.

Securing Nuts

Various schemes are used by designersto keep nuts from loosening. Lock washers, castellated nuts, and nuts with drilled holes are some of the devices used. Where a number of nuts are wired together, it is difficult to save the wire, consequently unless a supply of wire is kept on hand it is liable to be left off when the repair job is completed. In a good many cases, small iron wire is used which rapidly deteriorates. Wires are also likely to catch on clothes or scratch the operator's hands. A larger nonrusting seal wire would help in making the wires last longer. In summing up the situation, it may be said that the lock washer under the nut seems to be most suitable for a majority of cases.

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